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## SPECIAL ARTICLE

### THE RELATION OF THE CLINICAL LABORATORIES TO THE PRACTICE OF MEDICINE \*

By PAUL G. WOOLLEY, M. D., Los Angeles

*WHEN properly used, the laboratory is an auxiliary rather than a handicap to the development of the "clinical senses," as has been frequently charged.*

*The line connecting clinical medicine and the laboratory is a dotted one. A clinical laboratory is not a diagnostic institute.*

*The most important service of a laboratory is to give the physician something to think about and to consult or read about. The laboratory is the assistant to the physician—not his master. It can never replace trained hands, eyes, and ears.*

meeting of staff and discussed in detail." I call these sentences to your attention in order to emphasize the fact that the laboratory work is called for as a last resort, otherwise full clinical notes could not accompany the requests made upon the laboratory, and that the case reports are discussed by a full staff which includes the laboratory men.

The St. Andrews Institute is the most modern model of a thorough clinic. The relation of the laboratory to the clinic as a whole is interesting. It is also interesting in respect of recent opinions regarding the relation of the laboratory to general medicine.

Recently, Dr. Wilbur has inferred that bringing in the laboratory has crowded out the clinical senses. He says: "We must understand how to get our hands on the patient. The personal touch is essential. We must get back into medicine the personal element. The distant approach through the laboratory is ruinous to the confidential relationship of patient and physician. The dramatic discoveries of the laboratory have numbed the talents of the five senses." (Personally, I think Dr. Wilbur should have said the six senses.)

Sir James Mackenzie believes that a "laboratory-trained observer cannot recognize any sign except those of a grosser kind, while the subtler and more elusive signs pass unrecognized." In clinical medicine the grosser kinds have to be detected, and the laboratory-trained observer can detect them, but his training has not enabled him to detect the subtler reactions, and hence he fails to obtain that skill in observation which is essential to the physician.

These quotations from the writings of prominent clinicians indicate that there is a tendency, to say the least, to conceive of the laboratory as something of a handicap to the continued development of the "clinical sense." The main objection seems to be that laboratory methods tend to the use of short cuts in diagnosis, and that they tend, therefore, to replace concentrated and trained personal observation, and often to erroneous conclusions. In other words, there seems to be a growing belief that careless use of laboratory methods results in clinical inefficiency. I personally believe that there is considerable truth in this attitude, but it seems to me that the fault is rather on the side of the clinic than on that of the laboratory, though both have a share.

It is not so much that laboratory reports are misleading, or even incorrect, but that they tend to make the physician rely too little upon himself. This may not be essentially or intrinsically bad for the patient, but for the physician it is a pity.

I should like to remark just at this point that the generalized practice of vaccine therapy exemplifies nicely this point. A great deal of vaccine therapy has led many practitioners to a belief in *propter hoc*,

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I WISH to present the point of view that the laboratory is subsidiary in the practice of medicine. To at least a small extent, therefore, I differ from some clinical pathologists and pathologists who seem to confuse the tremendous theoretic and often distant practical value of the general laboratory as an institution; and the immediate value of the clinical laboratory in relation to medical practice.

In the reports of the St. Andrews' Institute, in the section devoted to case-taking methods, these sentences occur: "The necessary chemical, bacteriological, hematological and radiological investigations are carried out by the special departments devoted to these subjects, and with every specimen or case full clinical notes are supplied to the special departments. When the notes of each case are completed, they are read at a full

when the results were actually only *post hoc*. In many laboratories the preparation of vaccines, though not the giving of them—thank God—constitutes a large part of the work.

Perhaps the whole situation rests upon a foundation of faulty teaching, which, because of the wonderful achievements of experimental work with instruments and methods of precision, emphasizes the laboratory methods and neglects, to a corresponding degree, the very careful training of the unaided senses of the student of medicine. Students become laboratory-trained observers, in the sense of Mackenzie. It is not that they cannot recognize the "subtler and more elusive signs," but that they have not been trained to do so. They have less to do with patients than with materials from them. When it comes to a final analysis, Mackenzie himself used, for a time at least, laboratory methods and equipment which pointed out to him "the subtler and elusive signs" which he so much emphasizes, so that eventually it became possible for him to discard, more or less, the methods and instruments which taught him.

This accentuation of the laboratory methods and the relative disregard of dependence upon the unaided senses have, it is true, led to a state of affairs which is to be deplored. It is probably easier to teach the use of the methods of the laboratory alone than to teach the use of the five senses, and cultivate the sixth. There is the feeling in certain quarters that at least part of the trouble lies in the curriculum of the medical school, and with this feeling comes the suggestion to smash the curriculum and then remold it nearer to the heart's desire. But there is not so much need "to smash the present curriculum and revamp it to bring it up to the medical requirements of modern knowledge" as to correlate its parts so that pre-medical and medical courses are co-ordinated and so related to one another and so made use of one in another, that the scientific requirements of modern medicine are met. Present courses are often, as Dr. Wilbur says, ridiculous, but often this is true because they are taught as so-called medical courses. There is no such thing as medical chemistry until after a firm foundation has been laid in pure physics and chemistry. It is because of such so-called "medical courses" that the scientific world is making progress more rapidly than the ordinary medical school has been able to assimilate the results. It may not be necessary for the practicing physician to know the details of modern physics and chemistry, or to know the exact technic of a test for blood sugar, but he ought to know the general principles. If premedical physics and chemistry were used in the courses following through in the curriculum; if physics and chemistry were actively correlated with anatomy, physiology, biochemistry, pathology and physical diagnosis, a great gain could be made. In other words, make the laboratory courses kinetic instead of static. Such a correlation or system of correlations would result in some sort of "case-methods" of teaching medicine, for which much could be said. If Cushing's suggestion to invert the curriculum were tried, the danger of divorcing pre-medical science and medical courses would be enhanced.

The present system of medical teaching has re-

sulted in the isolation of the clinical laboratory, so that at the present time it occupies a place in medicine somewhat analogous to the place occupied by the anatomy of the nervous system or psychology in the curriculum. The line connecting clinical medicine and the laboratory is a dotted one.

In the scheme of medical practice, neither the pathologist nor the methods he uses occupy the place of greatest value. The pathologist is looked upon as a mere technician. In some instances, he is, fortunately, considered as a more or less magnified one. And yet he is expected, not uncommonly, to make diagnoses.

A clinical laboratory is not a diagnostic institution. By that is meant that it is not an institution in which the main object is to make diagnoses by means of specimens. It is an institution, a workshop, in which data of clinical value are sought and given to physicians to whom, when they are added to his clinical history, they have a definite meaning, with respect to his interpretation of a patient's ills. By means of such data, the physician is more easily able (or more quickly able) to arrive at a diagnosis, more accurately to estimate a prognosis, and more confidently to institute logical therapeutics.

In but few instances have clinical laboratories risen to the place they ought to occupy, for the reason that the need of them has grown at such surpassing speed that the demand for heads has exceeded the supply. Thus, it has come to pass that they have been organized chiefly to turn out reports, so to speak. Groups of physicians, hospitals, here and there, clinics everywhere have demanded technicians, not clinical pathologists, and have been willing to pay but technicians' wages up until the most recent times. And they have got just what they deserved—technicians' services. They have *not* got what they ought to have—very special skill and knowledge based upon training and experience. And, therefore, the laboratory has become too frequently only an adjunct of the group, of the hospital, of the clinic, instead of being an essentially integral part of each, upon a consultation basis. In the proper clinical laboratory the chief should be chosen partly for his skill, partly for his experience and judgment. To him the physician should come with problems to discuss, to get perspective, to get advice and information gleaned from fields which the practitioner cannot even be expected to know; for how can the busy doctor find time to read the various more specialized journals of medical chemistry, bacteriology, immunology and the like, when he has scarcely time—if he have even so much—to read his own local state journal and his national medical journal?

One of the best subjects to illustrate the interrelationships of clinical and laboratory studies is urinalysis, because in the clinic of renal disease the conclusions as to the functional activity and pathology of the kidney have been based very generally upon urine analytic reports.

There is not a single item looked for in a routine urinalysis which of itself means disease of the kidney. The presence of casts and albumin do not necessarily mean renal disease, nor does the presence of pus cells or of blood. Nor in case there is

actual disease of the kidneys does the amount of abnormal materials indicate necessarily the amount of disease. In Stark's series of 600 cases which came to autopsy, the clinical and anatomical diagnoses agreed with respect to the kidney) in but 36 per cent.

Certain conditions have been shown to be requisite for the secretion of a normal urine. In the first place, there must be at least 18 to 20 per cent of normal kidney weight. In other words, an animal may have lost from 75 to 80 per cent of his kidney substance and still preserve an adequate function, provided the surviving tissue is normal. In the second place, the vascular system must be sufficient, for, naturally enough, unless an adequate amount of blood can reach the kidneys, and unless the renal vessels have a normal permeability, the system will be lacking. In the third place, there must be a sufficient supply of free water, for otherwise the excess of salts cannot be carried out of the body in normal amounts, and will accumulate; and in the fourth place, there must be a free outlet from the body, for otherwise the fluid will be dammed back in the urinary system and will impair the renal secretory activities.

The facts are that the glomerulus secretes water and salts, and that the tubular system resorbs salts and excretes nitrogenous bodies. That being the case, one should be able to say in case of disease that, if there is salt and water retention, the glomerulus is the essentially damaged part of the organ, and that if nitrogen accumulates in the body the disease is essentially tubular. This sharp demarcation of disease can be produced experimentally no doubt, but it rarely occurs in nature, and so the features of renal disease are always mixed. Moreover, even fairly sharply delimited disease of the tubules may cause water retention, because swelling of the cells prevents the passage of water from the glomerulus through the tubules, and since that is true there can be no resorption of salts. It is impossible to demarcate the lesions because demarcation does not occur. Inflammatory nephropathies always (speaking generally) affect both glomerulus and tubules.

Another set of factors influence our clinical studies of nephritis, and these have to do with the distribution of renal lesions. In some cases the changes affect the whole organ; they are diffuse. In others they affect only parts of the organ; they are focal, "spotty." What does this mean? This, that if one part of the kidney is normal that part produces a normal urine. If one part is abnormal it produces an abnormal urine. The two urines mix in the pelvis and in the bladder, and the result is, of course, composite. That is one reason why urinalysis alone tells so little in many cases. It may even be that if there is sufficient normal tissue left it is able to do the complete secretion and absorption work for the body, and so nitrogenous bodies do not accumulate in the blood. It is such cases that show a normal or slightly abnormal blood nitrogen, a normal phthalein output, an almost normal urine, yet which are on the ragged edge between health and disability. And what of a state of affairs in which one kidney is badly damaged

and the other healthy! Here, of course, lack of elimination in one side will be taken care of in the other.

When one takes all these things into consideration he realizes at once that conclusions as to the state of the kidney drawn from studies of the urine alone may be "as brittle as the urinal." A kidney which is 50 to 75 per cent diseased may produce a normal urine, when the diseased portions are so damaged that they do not secrete. The normal urine comes from the normal parts of a diseased kidney. Isn't this exactly what happens in a so-called chronic interstitial nephritis?

Coffen has reported an intensive study of albuminuria, with special reference to its clinical significance, and says: "Albuminuria is not a sure indication of damaged kidneys; for it may appear when these organs are normal, as in orthostatic albuminuria, or it may be absent in a widespread degeneration of the kidneys as in interstitial nephritis. Furthermore, albuminuria may be excessive from passive congestion of the kidneys, the primary difficulty being in the heart. When albuminuria is excessive and associated with oliguria and apparent uremia, as a late event in arterial hypertension or in circulatory failure, it may cause much apprehension; on the other hand, the absence of albumin in the urine may give a false sense of security." From these and collateral remarks it is readily seen that dependence upon urinary findings alone leads to error.

In other words, a laboratory report which says, in effect, that the urine is normal does not mean necessarily that the kidneys are normal. Even Shakespeare knew that the urine itself might be a very healthy urine, but for the person who had the passing thereof, he might have more diseases than was suspected. And an abnormal urine may not refer to actual renal disease, but rather to a pathologic heart or to a damaged vascular system.

In other sectors of pathology, one finds similar states of affairs which emphasize the need of close co-operation between physician and pathologist. For instance, the absence of tubercle bacilli in a sputum does not mean absence of active pulmonary tuberculosis. A negative Wassermann is not proof of freedom from luetic infection.

Sometimes the laboratory is able to make a clean-cut diagnosis, but if one considers the volume of laboratory work, this is rare. What it does do is to give the physician something to think about and to consult or to read about. The laboratory is the assistant of the physician—not his master. It should not make him less careful, but more careful, and should help to keep him up to date in fields in which he does not work. It can never replace trained hands, and eyes, and ears, even though it oftentimes supplies some facts that are *essential* in aiding accurate diagnosis, in influencing prognosis, and in deciding problems of treatment.

The clinical laboratory should be the agency through which the physician is kept abreast of the advances of medical science which are founded upon physics, chemistry, bacteriology, and pathology.